Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Quantum Phase Transitions in the Kane-Mele-Hubbard Model[1] ZI YANG MENG, Center for Computation and Technology, Louisiana State University, MARTIN HOHENADLER, Institute for Theoretical Physics and Astrophysics, University of Wuerzburg, THOMAS C. LANG, STEFAN WESSEL, Institute for Theoretical Solid State Physics, RWTH Aachen University, ALEJANDRO MURAMATSU, Institut fuer Theoretische Physik III, Universitaet Stuttgart, FAKHER F. ASSAAD, Institute for Theoretical Physics and Astrophysics, University of Wuerzburg — We study the ground state phase diagram of the Kane-Mele-Hubbard model on the two-dimensional honeycomb lattice. At half-filling the phase diagram is mapped out using projective auxiliary field quantum Monte Carlo simulations. We present a refined phase boundary for the quantum spin liquid. The topological (quantum spin-Hall) insulator at finite Hubbard interaction strength is adiabatically connected to the ground state of the Kane-Mele model. For the magnetic phase at large Hubbard interaction strength, we show that the magnetic order is restricted to the transverse direction. The transition from the topological band insulator to the antiferromagnetic Mott insulator is in the universality class of the three-dimensional XY model. The numerical data also suggest that the spin liquid to topological insulator and spin liquid to Mott insulator transitions are both continuous.

[1]DFG funding through SFB/TRR 21, and WE 3639/2-1

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Date submitted: 09 Nov 2011 Electronic form version 1.4